

# Smartphone Video Guidance Sensor for Small Satellites

Completed Technology Project (2012 - 2012)



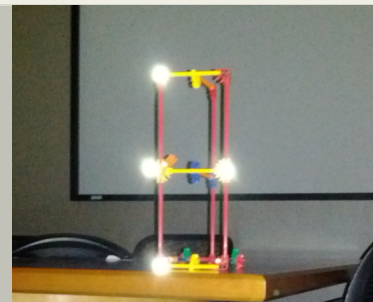
## Project Introduction

Smartphone Video Guidance Sensor(SVGS) for Small Satellites will provide a low-cost,integrated rendezvous & proximity operations sensor system to allow an approaching spacecraft to determine the position & attitude of a target spacecraft.The target vehicle will carry an array of target retroreflectors.The SVGS will image targets using a smartphone-type camera;then process the image using photogrammetry techniques to determine the range & relative orientation(6DOF)state of the target vehicle.

The primary objectives of this proposal are the following: 1.Demonstrate a video guidance sensor system running on a smartphone platform that can perform proximity operations on any cubesat or microsat. 2.Raise the TRL of the SVGS from TRL 2 to 4 on the path to future development to TRL 6 and ultimately a flight opportunity. 3.Reduce spacecraft component costs by demonstrating a COTS-based guidance sensor. 4.Further develop MSFC's small satellite development capabilities. Completion of this proposed work and subsequent development efforts to raise the TRL to a flight-ready level would increase MSFC's foothold into the growing small satellite market with a low-cost subsystem well suited to formation flying and other proximity operations. The small satellite market opportunities include Department of Defense (DoD), academia, and industry-led efforts. Other than the general use of the SVGS technology in the small satellite market, this technology lends itself more specifically to formation flying applications. Formation flying allows smaller, simpler spacecraft to coordinate and perform more complex missions. The simpler designs of the individual spacecraft result in shorter development times and lower cost. Additionally, a formation of spacecraft may have greater redundancy and ability to adapt to failures. Formation flying can also take advantage of unique mission capabilities such as higher resolution imaging and the ability to collect observations from multiple look angles to enhance mission results. Potential applications of formation flying include astronomy, communications, meteorology, and earth observation. To date, formation flying of more than two spacecraft is not known to have been demonstrated. By placing the SVGS on a group of 3 or more low-cost cubesats, this sensor would allow for the demonstration of multi-spacecraft formation flying. We will leverage off of past technology developments from the Advanced Video Guidance Sensor(AVGS).

## Anticipated Benefits

Low-cost sensor to enable nanosat and other small satellite multi-spacecraft formation flying and proximity operations



Project Image Smartphone Video Guidance Sensor for Small Satellites

## Table of Contents

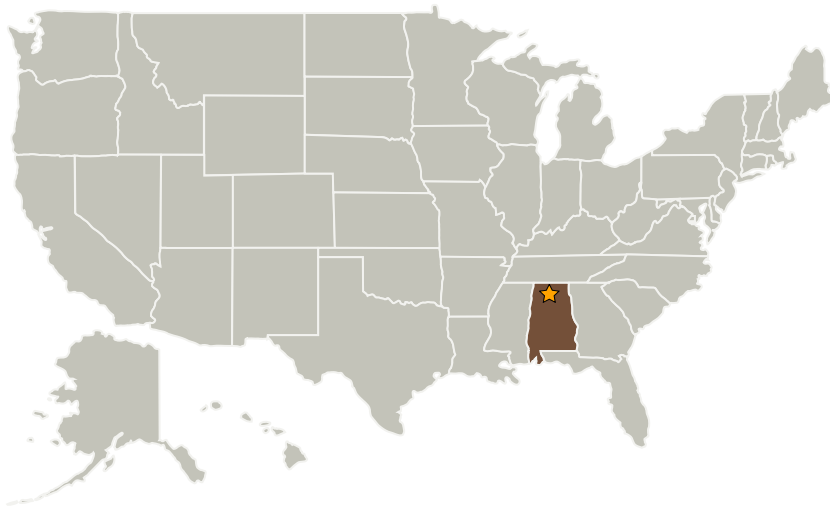
Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Organizational Responsibility	2
Project Management	2
Images	3
Technology Maturity (TRL)	3
Technology Areas	3

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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Marshall Space Flight Center (MSFC)	Lead Organization	NASA Center	Huntsville, Alabama

## Primary U.S. Work Locations

Alabama

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Center / Facility:**

Marshall Space Flight Center (MSFC)

**Responsible Program:**

Center Innovation Fund: MSFC CIF

## Project Management

**Program Director:**

Michael R Lapointe

**Program Manager:**

John W Dankanich

**Project Manager:**

Chris Becker

**Principal Investigator:**

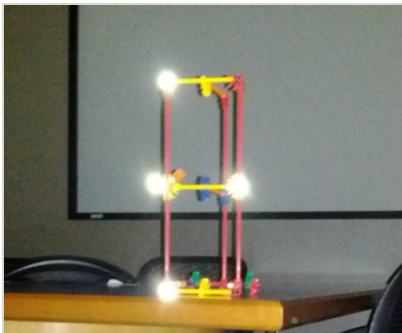
Chris Becker

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## Images

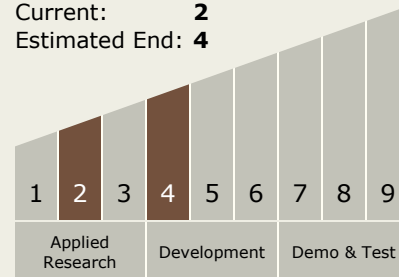


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Project Image Smartphone Video Guidance Sensor for Small Satellites  
(<https://techport.nasa.gov/image/1150>)

## Technology Maturity (TRL)

Start: 2  
Current: 2  
Estimated End: 4



## Technology Areas

### Primary:

- TX04 Robotic Systems
  - TX04.5 Autonomous Rendezvous and Docking
    - TX04.5.1 Relative Navigation Sensors